

Resist-Accept-Direct (RAD): A way of thinking about climate adaptation



John Morton, PhD



Co-evolution of two groups



Responding to Ecosystem Transformation: Resist, Accept, or Direct?

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Before and after photos of a coral bleaching event in American Samoa. Photo credit: The Ocean Agency/US Coast Guard/NOAA Fisheries. Photo credit: The Ocean Agency/US Coast Guard/NOAA Fisheries.

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National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Resist-Accept-Direct (RAD)—A Framework for the 21st-century Natural Resource Manager

Natural Resource Report NPS/NRSS CCRP/NRR—2020/2213

RAD is a decision framework

"One day Alice came to a fork in the road and saw a Cheshire cat in a tree.

'Which road do I take?' she asked.

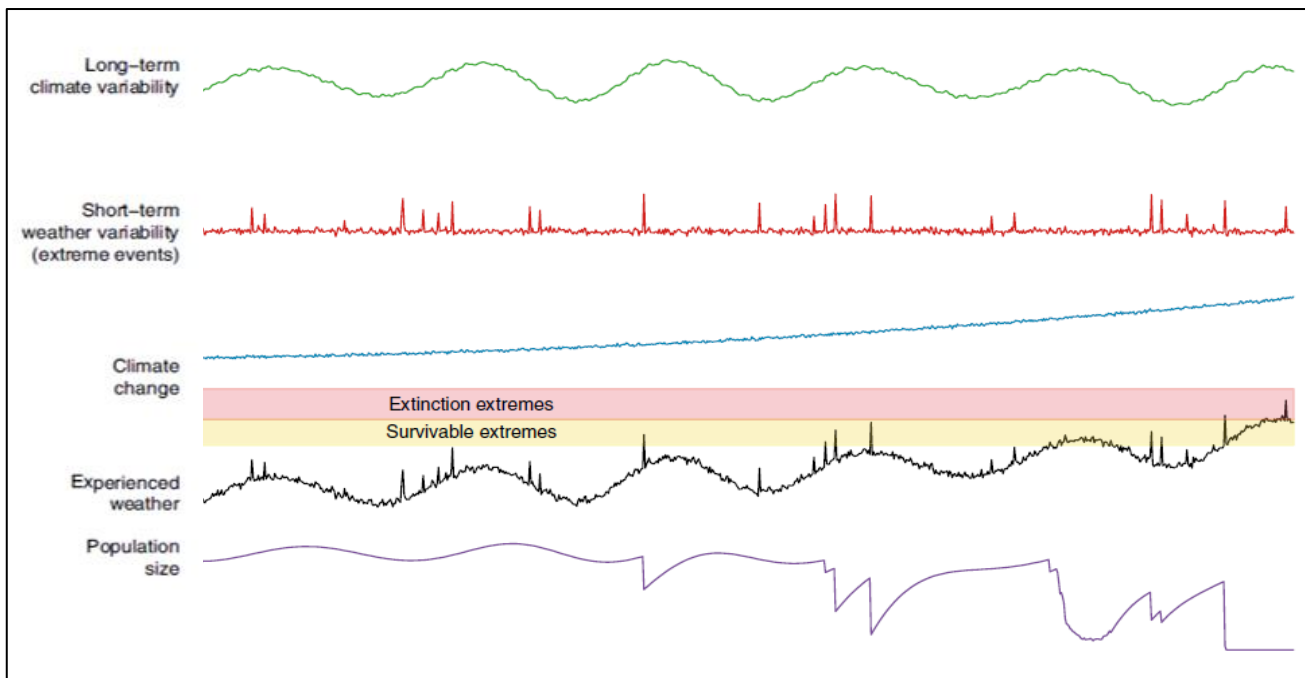
'Where do you want to go?' was his response.

'I don't know', Alice answered.

'Then', said the cat, 'it doesn't matter.'"



RAD addresses Directional Change and Ecological Transformation



Directional Change
unrelenting and unprecedented
change in key drivers of
ecological conditions

Ecological Transformation
“a dramatic, persistent, and
statistically ‘extreme’ shift in
multiple ecological
characteristics, the basis of which
is dramatic changes in species
composition”

Harris et al. 2018. Nature Climate Change 8:579-587

RAD framework squarely assigns the adaptation response to a managerial/societal decision

RESIST	ACCEPT	DIRECT
<p>Many changes will be RESISTED by managers, to maintain ecosystem processes, function, and composition toward a <u>historical</u> baseline</p>	<p>Many changes will be ACCEPTED by managers, perhaps because...</p> <ul style="list-style-type: none"> • Infeasible to be managed • insufficiently impactful to warrant response • acceptable to (even desirable by) stakeholders • unknowingly occurring • lack of will or impetus despite sufficient knowledge or resources 	<p>Some changes will be DIRECTED by managers toward a specific <u>future</u> state because...</p> <p>so dramatic that resisting is untenable and there is a feasible opportunity to steward change towards a more desirable outcome than what would be achieved with acceptance</p>

...with the goal of a self-sustaining, self-organizing system

Crib Notes

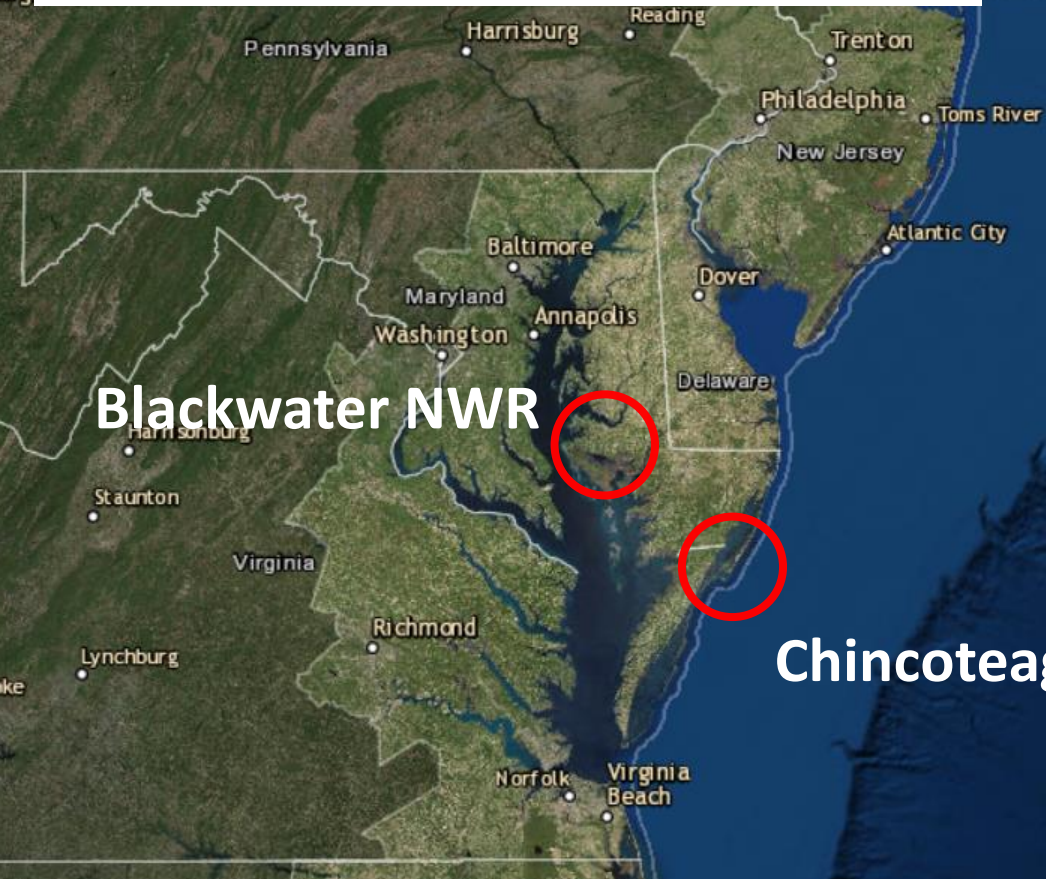
- 1) Goal is a self-sustaining, self-organizing system; not continual intervention
- 2) Three bins are all encompassing (i.e., nothing outside decision space), mutually exclusive, and NOT a continuum
 - however, one or all three bins can be applied sequentially or concurrently (i.e., portfolio approach)
 - comparison is among the three choices (all of which involve change), not with a static historic or natural baseline
 - awareness of all three bins promotes bet hedging
- 3) Technology (or the absence of it) does not dictate whether approach is R, A or D
- 4) ACCEPT does not imply the absence of management
- 5) Decision paralysis because of uncertainty is NOT an option; consider experimentation to test ecological outcomes and/or pilot studies of novel climate adaptation that can be scaled up (if successful)

Beyond I&M...

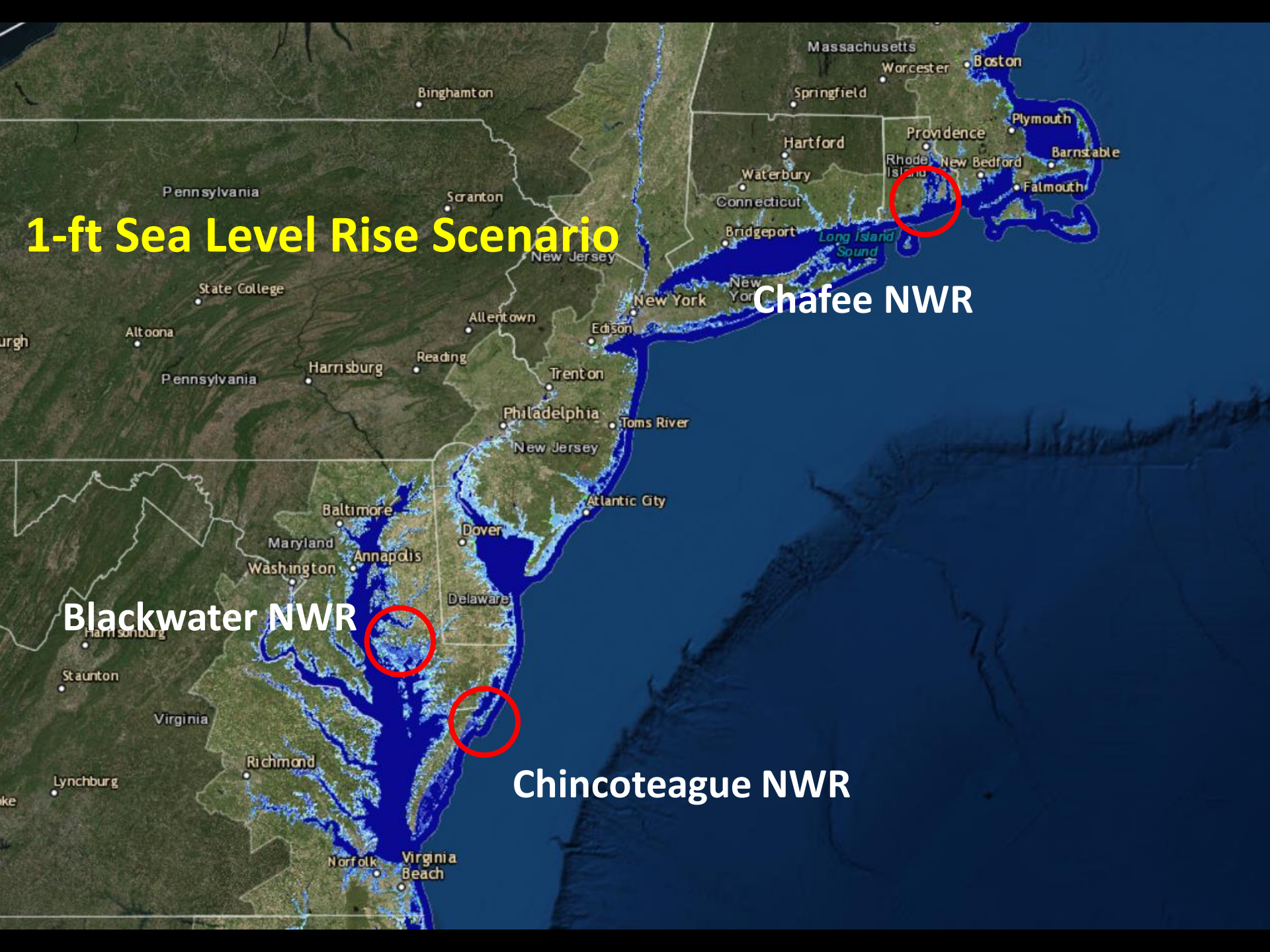
Experiments to test ecological trajectories and pilot studies of potential adaptation



**DIRECTIONAL CHANGE:
Responses of three National
Wildlife Refuges to sea-level rise**



1-ft Sea Level Rise Scenario



Chafee NWR

Blackwater NWR

Chincoteague NWR

ACCEPTING CHANGE: Chincoteague National Wildlife Refuge and Assateague Island National Seashore

- ✓ After 6 decades of maintaining artificial dunes, island will be allowed to overwash during storm events and migrate in response to long-shore current
- ✓ Since 2003, increasing storm damage to infrastructure (visitor center, roads, parking lots) has cost \$3.5 million
- ✓ NPS beach facilities moved inland and two refuge waterfowl impoundments will be allowed to deteriorate



ACCEPTING CHANGE: Chincoteague National Wildlife Refuge and Assateague Island National Seashore

- ✓ After 6 decades of maintaining artificial dunes, island will be allowed to overwash during storm events and migrate in response to long-shore current
- ✓ Since 2003, increasing storm damage to infrastructure (visitor center, roads, parking lots) has cost \$3.5 million
- ✓ NPS beach facilities moved inland and two refuge waterfowl impoundments will be allowed to deteriorate



RESISTING CHANGE: Chafee National Wildlife Refuge

- ✓ **\$1.4 million project uses thin-layer deposition to keep *Spartina patens* saltmarsh in situ**
- ✓ **3,000 bags of clam and oyster shells hold sediment and water on elevated marsh**
- ✓ **Amphibious excavator to disperse sediment**



Photo Credit: The Nature Conservancy

DIRECTING CHANGE: Blackwater National Wildlife Refuge

- ✓ Since 1938, 5,000 acres of tidal wetlands converted to open water, but 2,700 acres of new marsh created by upslope migration (**ACCEPT**)
- ✓ Thin-layer deposition holds some marsh in situ (**RESIST**)
- ✓ A partnered \$475K demonstration project facilitates marsh migration by extending the head of tidal creek with low-ground-pressure excavator (**DIRECT**)



Same problem but three structural adaptation approaches



RESIST: Hard armoring of Kivalina



ACCEPT: Allow the loss of Newtok

DIRECT: Construct Evacuation Road/Center at Mertarvik



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RESIST: Hard armoring of Kivalina



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Accept-Direct Framework

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Coding for Life

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It's not rocket science...



...it's harder

